
Unit 6

BCAs for Tornado Safe Rooms, Hurricane Safe Rooms, and
Hurricane Wind Projects

Objectives

At the end of this unit, participants will be able to:

- Explain BCA data and documentation requirements for tornado safe rooms, hurricane safe rooms, and hurricane wind retrofit projects
- Complete a tornado safe room BCA
- Complete a hurricane safe room BCA
- Complete a wind retrofit BCA for a critical facility

Scope

- Unit 6 Overview & Objectives
- Tornado hazard overview
- Tornado safe room project basics and pre-calculated benefit
- Tornado safe room BCA: BCA Toolkit Exercise and data input overview
- Hurricane safe room project basics
- Hurricane safe room BCA: BCA Toolkit Exercise and data input overview
- Hurricane wind retrofit project basics and pre-calculated benefits
- Hurricane wind retrofit BCA for critical facility: BCA Toolkit Exercise and data input overview
- Unit 6 Review

Methodology

This unit will be delivered as an in-person classroom course, and will use a combination of lecture and discussion.

The instructor will introduce the unit and then go through each slide, pausing for questions and short discussion if needed. The instructor should also prompt students to follow along in their Student Manuals.

Since this is a longer unit, the instructor is encouraged to give the class breaks as needed.

BCA Toolkit Exercise/Case Studies

When the “BCA Toolkit Exercise” slides appear in the presentation (see Figure 1 below), the instructor should open the BCA Toolkit and have the students also open the Toolkit on their computers. The instructor should then guide the students through completing data entry for the project type(s) being discussed, using the slides that follow to describe the data inputs for that project type. As you enter values into the Toolkit, make sure to point out the comment boxes and show how a user would enter a comment describing where they obtained the value and referring the reviewer to the appropriate document in their project application.

Note that once a particular data input (i.e. number of occupants) is covered in a slide it is not covered again in subsequent project type exercises.

BCA Toolkit Exercise, Part 1

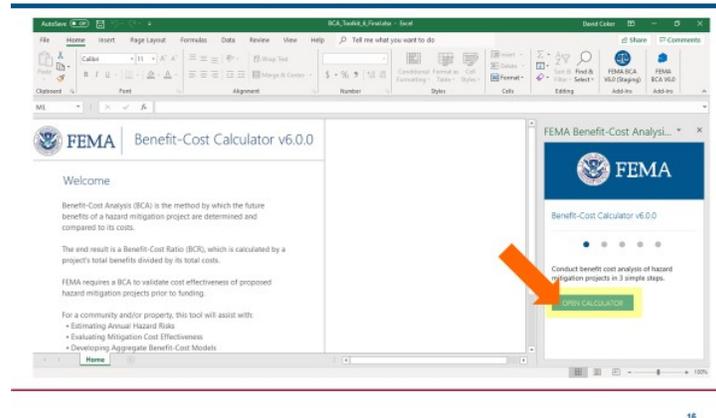


Figure 1: BCA Toolkit Exercise slide

Several case studies are provided as supplements to the training material and may be downloaded at <https://www.fema.gov/benefit-cost-analysis>. These case studies may be used during the BCA Toolkit exercise portions of the unit. However, instructors are encouraged to use examples from their own Regions or states if appropriate. Students are also encouraged to use projects they might be working on and have the instructors and other students offer suggestions on how to input the data in the BCA Toolkit.

Time Plan

The instructor should advise students that this will be a long unit, but that the class will take a break(s) when needed.

A suggested time plan for each topic in this unit is shown below. More or less time may be required, based on the experience level of the group.

- Unit 6 Overview & Objectives (5 minutes)
- Tornado hazard overview (10 minutes)
- Tornado safe room project basics and pre-calculated benefit (10 minutes)
- Tornado safe room BCA: BCA Toolkit Exercise and data input overview (25 minutes)
- Hurricane safe room project basics (5 minutes)
- Hurricane safe room BCA: BCA Toolkit Exercise and data input overview (15 minutes)
- Hurricane wind retrofit project basics and pre-calculated benefits (15 minutes)
- Hurricane wind retrofit BCA for critical facility: BCA Toolkit Exercise and data input overview (30 minutes)
- Unit 6 Review (5 minutes)

Total Time (Estimated): 2 hours

Materials

- Unit 6 Visuals
- Unit 6 Instructor Guide
- Unit 6 Student Manual
- Computer/BCA Toolkit 6.0
- Internet connectivity (to access FEMA memos/Job Aids and ATC Council website)

Unit 6 Overview

Unit 6 Overview

- This unit will cover:
 - Project basics, data and documentation requirements, and BCA Toolkit exercises for:
 - Tornado safe rooms
 - Hurricane safe rooms
 - Hurricane wind retrofits

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Visual 1: Unit 6 Overview

Instructor:

This unit will cover:

- Project basics, data and documentation requirements, and BCA Toolkit exercises for:
 - Tornado safe rooms
 - Hurricane safe rooms
 - Hurricane wind retrofits

Unit 6 Objectives

Unit 6 Objectives

- At the end of this unit, participants will be able to:
 - Explain BCA data and documentation requirements and complete a BCA for:
 - Community tornado safe room
 - Hurricane safe room
 - Hurricane wind retrofit of a critical facility

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Visual 2: Unit 6 Objectives

Instructor:

Unit 6 has several objectives. At the end of this unit, students should be able to:

- Explain BCA data and documentation requirements for tornado safe rooms, hurricane safe rooms, and hurricane wind retrofit projects
- Complete a community tornado safe room BCA
- Complete a hurricane safe room BCA
- Complete a critical facility hurricane wind retrofit BCA

Tornado Safe Rooms

Tornado Safe Rooms

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Instructor:

First we'll talk about tornadoes and tornado safe rooms.

Tornadoes

Tornadoes

- A tornado is a violent, rotating, funnel-shaped cloud that extends from a thunderstorm to the ground, with winds that can reach 300 miles per hour.
- Tornadoes are classified by the Enhanced Fujita (EF) Scale, which correlates wind speeds with damage, and takes into account the quality and type of structure that has been damaged to estimate wind speeds.



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Visual 3: Tornadoes

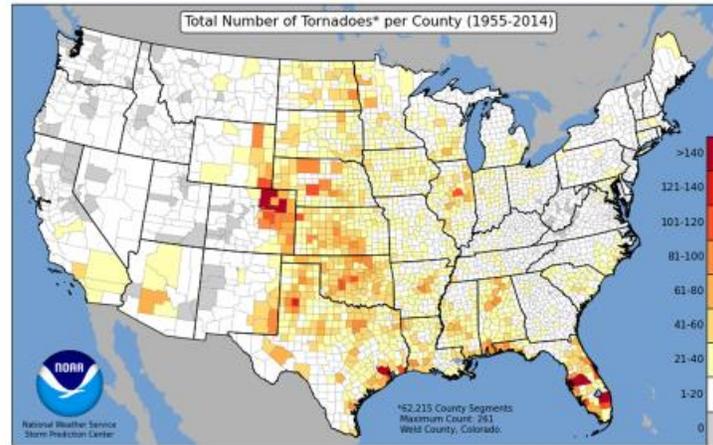
Instructor:

A tornado is a violent, rotating, funnel-shaped cloud that extends from a thunderstorm to the ground, with winds that can reach 300 miles per hour.

Tornadoes are classified by the Enhanced Fujita (EF) Scale, which correlates wind speeds with damage, and takes into account the quality and type of structure that has been damaged to estimate wind speeds.

Tornado occurrence

Tornado occurrence



Visual 4: Tornado occurrence

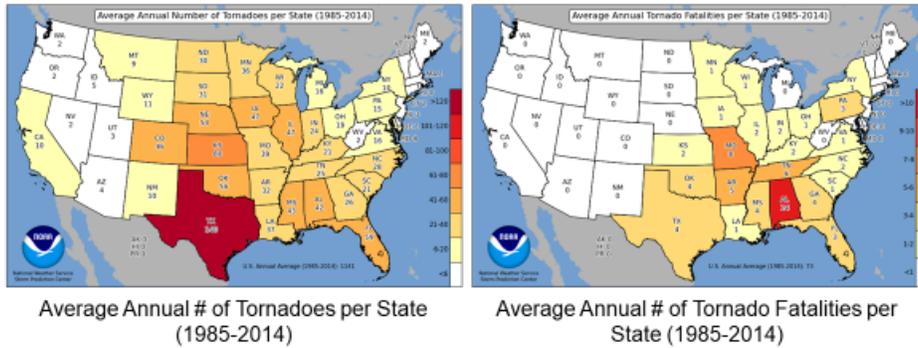
Instructor:

The map in the image shows the total number of tornadoes per county between 1955 and 2014.

Source: National Oceanic and Atmospheric Administration (NOAA)

Tornado risk

Tornado risk



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Visual 5: Tornado risk

Instructor:

The maps in the image show (1) the average annual number of tornadoes per state between 1955 and 2014 and (2) the average annual tornado fatalities per state between 1955 and 2014.

Source: National Oceanic and Atmospheric Administration (NOAA)

EF scale classifications

Enhanced Fujita (EF) scale classifications

Category	3-Second Wind Gust
EF0	65-85 mph
EF1	86-100 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

Visual 6: EF scale classifications

Instructor:

The slide shows the Enhanced Fujita (EF) scale classifications.

- A category EF0 tornado has a 3-second wind gust between 65-85 mph.
- A category EF1 tornado has a 3-second wind gust between 86-100 mph.
- A category EF2 tornado has a 3-second wind gust between 111-135 mph.
- A category EF3 tornado has a 3-second wind gust between 136-165 mph.
- A category EF4 tornado has a 3-second wind gust between 166-200 mph.
- A category EF5 tornado has a 3-second wind gust greater than 200 mph.

EF0 and EF1

EF0 and EF1**EF0: Gale Tornado Category**

- 65-85 mph
- Light damage

**EF1: Moderate Tornado Category**

- 86-110 mph
- Moderate damage



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*Visual 7: EF0 and EF1***Instructor:****EF0: Gale Tornado Category**

- 65-85 mph
- Light damage

EF1: Moderate Tornado Category

- 86-110 mph
- Moderate damage

EF2 and EF3

EF2 and EF3

EF2: Significant Tornado Category

- 111-135 mph
- Considerable damage

**EF3: Severe Tornado Category**

- 136-165 mph
- Severe damage



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Visual 8: EF2 and EF3

Instructor:**EF2: Significant Tornado Category**

- 111-135 mph
- Considerable damage

EF3: Severe Tornado Category

- 136-165 mph
- Severe damage

EF4 and EF5

EF4 and EF5

EF4: Devastating Tornado Category

- 166-200 mph
- Devastating damage

**EF5: Incredible Tornado Category**

- >200 mph
- Incredible damage



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Visual 9: EF4 and EF5

Instructor:**EF4: Devastating Tornado Category**

- 166-200 mph
- Devastating damage

EF5: Incredible Tornado Category

- >200 mph
- Incredible damage

Tornado safe rooms

What are tornado safe rooms?

- Tornado safe rooms provide protection in high-wind events.
- However, the benefits of this project type are limited to life safety benefits, i.e. avoided injuries and deaths.

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Visual 10: What are tornado safe rooms?

Instructor:

Tornado safe rooms provide protection in high-wind events.

However, the benefits of this project type are limited to life safety benefits, i.e. avoided injuries and deaths.

Tornado safe room types

Tornado safe room types

Residential Safe Room

- Provides a place of refuge for the people who live in the home
- Various types/designs



Community Safe Room

- Constructed to protect a large number of people



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Visual 11: Tornado safe room types

Instructor:

There are two main types of tornado safe rooms.

Residential Safe Room

- Provides a place of refuge for the people who live in the home
- Various types/designs

Community Safe Room

- Constructed to protect a large number of people

FEMA guidance on tornado safe rooms

FEMA guidance on tornado safe rooms

FEMA Publication 361:

- Community safe rooms

FEMA Publication 320:

- Residential safe rooms



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Visual 12: FEMA guidance on tornado safe rooms

Instructor:

FEMA has issued design guidelines for tornado safe rooms.

FEMA Publication 361:

- Community safe rooms

FEMA Publication 320:

- Residential safe rooms

Pre-calculated benefit

Pre-calculated benefit

- For residential tornado safe rooms, FEMA has developed a pre-calculated benefit.
- If the total project cost per property does not exceed the values in the table, the project is cost-effective and does not need a separate BCA.

Aggregate Benefits By State (Abridged List)			
Alabama	\$13,336.96	Nebraska	\$9,921.78
Arkansas	\$16,717.85	North Carolina	\$5,723.26
Georgia	\$5,290.98	Ohio	\$11,469.38
Illinois	\$13,685.72	Oklahoma	\$18,366.36
Iowa	\$14,962.87	Pennsylvania	\$4,065.90
Indiana	\$18,126.34	South Carolina	\$6,139.38
Kansas	\$14,005.75	South Dakota	\$5,230.17
Kentucky	\$13,554.96	Tennessee	\$13,579.58
Louisiana	\$9,921.94	Texas	\$5,421.32
Michigan	\$6,522.49	Virginia	\$3,936.05
Missouri	\$15,654.96	West Virginia	\$4,973.50
Mississippi	\$20,067.64	Wisconsin	\$9,025.48
Minnesota	\$7,092.39		

For more information, see the [Job Aid](#).

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Visual 13: Pre-calculated benefit

Instructor:

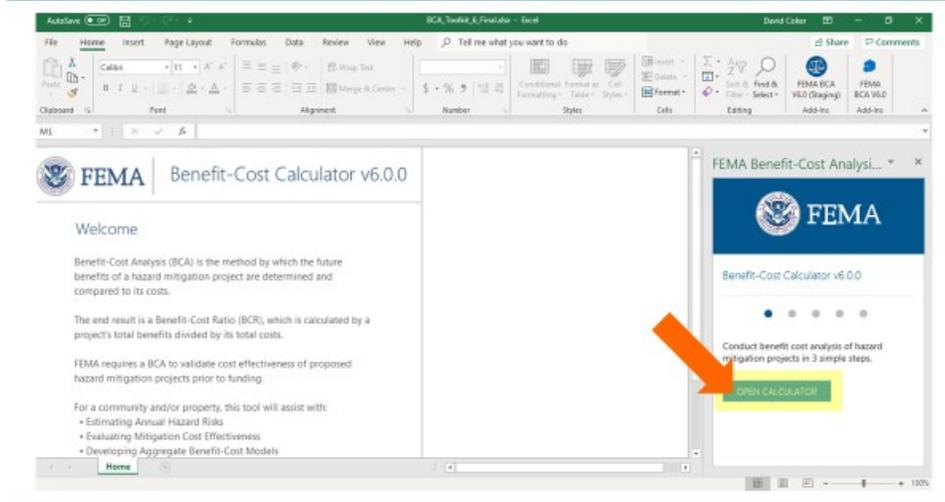
For residential tornado safe rooms, FEMA has developed a pre-calculated benefit.

If the total project cost per property does not exceed the values in the table in the [Job Aid](#), the project is cost-effective and does not need a separate BCA.

Applicants must use the Expedited Hazard Mitigation Grant Program (HMGP) Application for Residential Safe Rooms to apply pre-calculated benefits under HMGP. See the Job Aid for more details.

BCA Toolkit Exercise

BCA Toolkit Exercise, Part 2



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Instructor:

We will show how to complete a tornado safe room BCA in the BCA Toolkit. The following slides describe the data inputs in the Toolkit, sources for finding this information, and required documentation with your project application.



The instructor should open the BCA Toolkit on their computer and instruct the students to do the same. Use the following slides to describe each data point as it is input. You may use one of the provided case studies (or another example from a Region or state) to guide the students through data entry on the Project Configuration and then the Project Information screens.

Case studies may be downloaded at <https://www.fema.gov/benefit-cost-analysis>.

You may also show students the Data Documentation Templates for this project type, which may be found at <https://www.fema.gov/benefit-cost-analysis>.

Maximum safe room occupancy



Maximum safe room occupancy

- **Why it's important:**

- The occupancy of the safe room is the primary driver of the project benefits. The higher the occupancy, the greater the benefits.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Project scope of work (SOW) • Project manager or engineer 	<ul style="list-style-type: none"> • For residential safe rooms: the average household size per U.S. Census data; letter from homeowner certifying number of occupants • For community safe rooms: school enrollment records, employment data, and average daily visitor logs; records of number of business employees; historical site usage records

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Visual 14: Maximum safe room occupancy

Why it's important:

- The occupancy of the safe room is the primary driver of the project benefits. The higher the occupancy, the greater the benefits.

Source(s):

- Project SOW
- Project engineer

Recommended BCA documentation with application:

- For residential safe rooms: the average household size per U.S. Census data; letter from homeowner certifying number of occupants
- For community safe rooms: school enrollment records, employment data, and average daily visitor logs; records of number of business employees; historical site usage records

Windspeed design



Windspeed design

- **What it is:**
 - The maximum wind speed (in mph) the safe room is designed to withstand.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Project scope of work (SOW) • Project manager or engineer 	<ul style="list-style-type: none"> • None other than normally required project materials

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Visual 15: Windspeed design

What it is:

- The maximum wind speed (in mph) the safe room is designed to withstand.

Why it's important:

- The design wind speed of the safe room determines the level of protection, i.e. the project effectiveness.

Source(s):

- Project SOW
- Project engineer

Recommended BCA documentation with application:

- None other than normally required project materials

Type(s) of structure(s) safe room occupants are coming from by %



Type(s) of structure(s) safe room occupants are coming from by %

- **What it is:**
 - The type(s) of structure(s) the safe room occupants are coming from, by the percentage of total occupants, during different periods of the day. For example, a school safe room might have 100% of its occupants coming from a school during the day, but during the evening 80% of the occupants come from nearby homes and only 20% from the school.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Project scope of work (SOW) • Project manager or engineer 	<ul style="list-style-type: none"> • Note from project manager or BCA analyst explaining how percentages were derived

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Visual 16: Type(s) of structure(s) safe room occupants are coming from by %

What it is:

- The type(s) of structure(s) the safe room occupants are coming from, by the percentage of total occupants, during different periods of the day. For example, a school safe room might have 100% of its occupants coming from a school during the day, but during the evening 80% of the occupants come from nearby homes and only 20% from the school.

Why it's important:

- The BCA Toolkit compares the expected injury/death rates within the evacuated structure type(s) to the expected injury/death rates if those people were in the proposed safe room. These are the benefits of the project.

Source(s):

- Project SOW

Recommended BCA documentation with application:

- Note from project manager or BCA analyst explaining how percentages were derived

Response rate



Response rate

- **What it is:**
 - Only a certain percentage of potential occupants is likely to actually come to the safe room in a tornado event, especially during off hours.
 - The default values are 100% (day), 85% (evening), and 60% (night).

Input required?	Potential sources for non-default values	Recommended documentation with application
No	<ul style="list-style-type: none"> • Project scope of work (SOW) 	<ul style="list-style-type: none"> • Note from project manager or BCA analyst explaining why non-default values were used

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Visual 17: Response rate

What it is:

- Only a certain percentage of potential occupants is likely to actually come to the safe room in a tornado event, especially during off hours.
- The default values are 100% (day), 85% (evening), and 60% (night).

Why it's important:

- The BCA Toolkit uses expected response rates to calculate an average occupancy for the safe room.

Source(s) for non-default values:

- Project scope of work (SOW)

Recommended BCA documentation with application:

- Note from project manager or BCA analyst explaining why non-default values were used

Hurricane safe rooms

Hurricane Safe Rooms

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Instructor:

From a BCA standpoint, hurricane safe rooms are almost identical to tornado safe rooms. We'll do an exercise in the Toolkit in a moment. First we'll talk about some project basics for hurricane safe rooms.

Hurricane safe rooms

What are hurricane safe rooms?

- Hurricane safe rooms provide sustained protection in high-wind events.
- However, they are intended only for occupants that cannot otherwise evacuate, such as first responders, hospital staff/patients, etc.
- As with tornado safe rooms, the benefits of this project type are limited to life safety benefits, i.e. avoided injuries and deaths.

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Visual 18: What are hurricane safe rooms?

Instructor:

Hurricane safe rooms provide sustained protection in high-wind events.

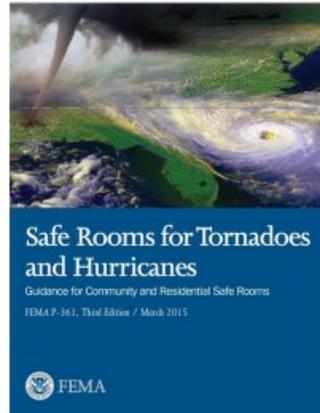
However, they are intended only for occupants that cannot otherwise evacuate, such as first responders, hospital staff/patients, etc.

As with tornado safe rooms, the benefits of this project type are limited to life safety benefits, i.e. avoided injuries and deaths.

Hurricane safe rooms

Types of hurricane safe rooms

- New construction vs. retrofit
- Internal vs. stand-alone
- FEMA Publication 361 provides guidance on hurricane safe room design and operation requirements.



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Visual 19: Types of hurricane safe rooms

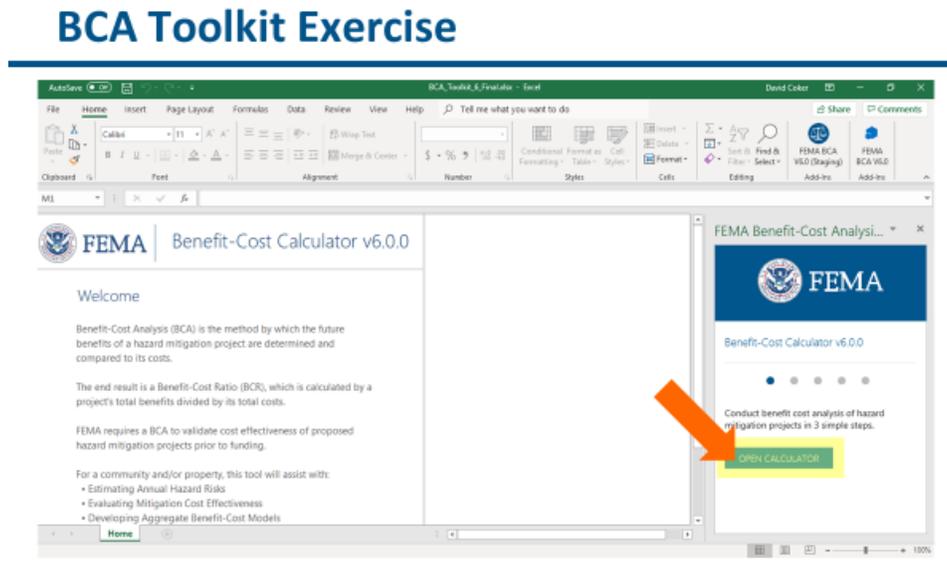
Instructor:

There are multiple ways to construct a hurricane safe room:

- New construction vs. retrofit
- Internal vs. stand-alone

FEMA Publication 361 provides guidance on hurricane safe room design and operation requirements.

BCA Toolkit Exercise



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Instructor:

Hurricane safe room BCAs are almost identical to tornado safe room BCAs. The only real difference is that you have to input the wind speed and recurrence interval data for the location, which we will discuss on the next slide.



The instructor should open the BCA Toolkit on their computer and instruct the students to do the same. Use the following slides to describe each data point as it is input. You may use one of the provided case studies (or another example from a Region or state) to guide the students through data entry on the Project Configuration and then the Project Information screens.

Case studies may be downloaded at <https://www.fema.gov/benefit-cost-analysis>.

You may also show students the Data Documentation Templates for this project type, which may be found at <https://www.fema.gov/benefit-cost-analysis>.

 Recurrence intervals and wind speeds



Recurrence intervals and wind speeds

- **What it is:**
 - The windspeed values and recurrence intervals for the structure location.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • https://hazards.atcouncil.org/ 	<ul style="list-style-type: none"> • Screenshot of data from ATC website

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Visual 20: Recurrence intervals and wind speeds

What it is:

- The windspeed values and recurrence intervals for the structure location.

Source(s):

- <https://hazards.atcouncil.org>

Recommended BCA documentation with application:

- Screenshot of data from ATC website

The instructor should navigate to the ATC Council website and demonstrate how to enter a location and look up the wind speed values.

Hurricane wind retrofits

Hurricane Wind Retrofits

Hurricane wind retrofits

What are hurricane wind retrofits?

- Four project types:
 - Shutters
 - Load path
 - Roof retrofit
 - Code Plus

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Visual 21: What are hurricane wind retrofits?

Instructor:

For hurricane wind retrofits, there are four project types:

- Shutters
- Load path
- Roof retrofit
- Code Plus

Let's discuss each of these.

Shutters

Shutters

- Designed to protect all windows and doors
- Must meet the debris impact and wind pressure design requirements of the International Residential Code/ International Building Code
- Assumes all openings of a building will be protected



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Visual 22: Shutters

Instructor:

Hurricane shutter projects are designed to protect all windows and doors.

They must meet the debris impact and wind pressure design requirements of the International Residential Code/ International Building Code.

This project type assumes all openings of a building will be protected.

Load path

Load path

- Structural retrofit project
- Aims to improve the structural system of a building to transfer loads from the roof to the foundation



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Visual 23: Load path

Instructor:

Retrofitting a building's load path is a structural retrofit project.

It aims to improve the structural system of a building to transfer loads from the roof to the foundation.

Roof retrofit

Roof retrofit

- Structural retrofit project
- Aims to secure the building envelope and integrity during a wind event



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Visual 24: Roof retrofit

Instructor:

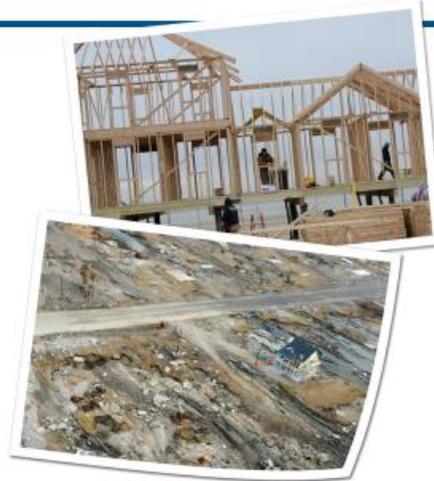
This is also a structural retrofit project.

It aims to secure the building envelope and integrity during a wind event.

Code Plus

Code Plus

- A code plus project is a project designed to exceed the local building codes and standards to achieve a greater level of protection.
- An example of a code plus wind project is the construction of a new building to a design wind speed of 120 mph despite the local code only requiring a design wind speed of 90 mph.



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Visual 25: Code Plus

Instructor:

A code plus project is a project designed to exceed the local building codes and standards to achieve a greater level of protection.

An example of a code plus wind project is the construction of a new building to a design wind speed of 120 mph despite the local code only requiring a design wind speed of 90 mph.

Pre-calculated benefits for hurricane wind retrofits

Pre-calculated benefits

- [Residential wind retrofits](#)

Mitigation Package Type	Roof Replacement Project	Maximum Costs
Intermediate Protection	No	\$13,153.00
Intermediate Protection	Yes	\$24,920.00
Advanced Protection	No	\$40,252.00
Advanced Protection	Yes	\$52,018.00

- [Non-residential wind retrofits](#)

- Hospitals, schools, etc.
- If total project cost is less than 10% of the Building Replacement Value (BRV), the project is considered cost-effective and a BCA is not required.

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Visual 26: Pre-calculated benefits for hurricane wind retrofits

Instructor:

FEMA has issued pre-calculated benefits for hurricane wind retrofits on both residential and non-residential structures.

The links in your Student Manual provide the relevant documents for more information.

[Residential wind retrofits](#)

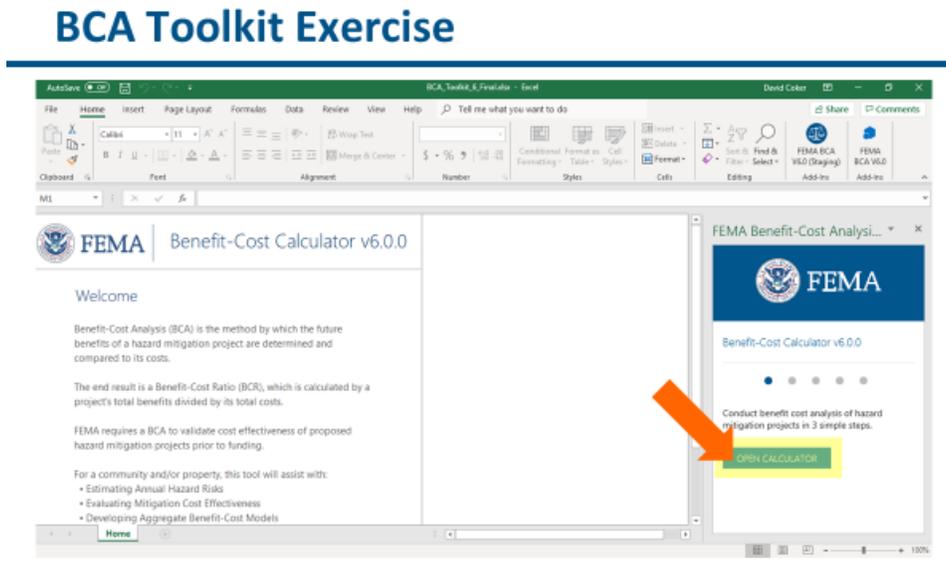
Mitigation Package Type	Roof Replacement Project	Maximum Costs
Intermediate Protection	No	\$13,153.00
Intermediate Protection	Yes	\$24,920.00
Advanced Protection	No	\$40,252.00
Advanced Protection	Yes	\$52,018.00

Figure 2: Pre-calculated benefit for residential hurricane wind retrofits

[Non-residential wind retrofits](#)

- Hospitals, schools, etc.
- If total project cost is less than 10% of the Building Replacement Value (BRV), the project is considered cost-effective and a BCA is not required.
- For Puerto Rico and the U.S. Virgin Islands, if the total project cost is less than 25% of the BRV the project is cost-effective.
- See memo for details.

BCA Toolkit Exercise



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Instructor:

We will show how to complete a hurricane wind retrofit BCA in the BCA Toolkit. The following slides show the data inputs, sources, and documentation requirements.



The instructor should open the BCA Toolkit on their computer and instruct the students to do the same. Use the following slides to describe each data point as it is input. You may use one of the provided case studies (or another example from a Region or state) to guide the students through data entry on the Project Configuration and then the Project Information screens.

Case studies may be downloaded at <https://www.fema.gov/benefit-cost-analysis>.

You may also show students the Data Documentation Templates for this project type, which may be found at <https://www.fema.gov/benefit-cost-analysis>.

 Recurrence interval and wind speed data



Recurrence interval and wind speed data

- **What it is:**
 - The windspeed values and recurrence intervals for structure location. The Toolkit populates default values but the user may enter their own.

Input required?	Potential sources for non-default values	Recommended documentation with application
No	<ul style="list-style-type: none"> • Qualified engineer or other professional • Study from credible source 	<ul style="list-style-type: none"> • Relevant page(s) from study from credible source • Note or letter from engineer or other qualified professional explaining why non-default values were used

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Visual 27: Recurrence interval and wind speed data

What it is:

- The windspeed values and recurrence intervals for structure location. The Toolkit populates default values but the user may enter their own.

Potential source(s) for non-default values:

- Project Scope of Work (SOW)
- Project engineer
- Photos

Recommended BCA documentation with application:

- Relevant page(s) from study from credible source
- Note or letter from engineer or other qualified professional explaining why non-default values were used

Exposure type



Exposure type

- **What it is:**
 - Exposure is the characteristics of the ground roughness and surface irregularities in the vicinity of a building.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Project scope of work (SOW) • Project manager or engineer • Photos 	<ul style="list-style-type: none"> • Note from project engineer or BCA analyst • Photos

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Visual 28: Exposure type

What it is:

- Exposure is the characteristics of the ground roughness and surface irregularities in the vicinity of a building.

Why it's important:

- The debris exposure type determines what type of debris might impact the building in a hurricane event, which helps estimate future damages.

Source(s):

- Project Scope of Work (SOW)
- Project engineer
- Photos

Recommended BCA documentation with application:

- Note from project engineer or BCA analyst
- Photos

Building occupancy class (*non-residential only*)



Building occupancy class (*non-residential only*)

- **What it is:**
 - Building occupancy class is the general use of the building.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Project Scope of Work (SOW) • Property owner 	<ul style="list-style-type: none"> • Note from project engineer or BCA analyst

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Visual 29: Building occupancy class (non-residential only)

What it is:

- Building occupancy class is the general use of the (non-residential) building.

Why it's important:

- The occupancy class determines the default contents value and displacement cost multipliers.

Source(s):

- Project Scope of Work (SOW)
- Property owner

Recommended BCA documentation with application:

- Note from project engineer or BCA analyst

 Type of construction



Type of construction

- **Why it's important:**
 - The BCA Toolkit uses the structure's construction type to estimate potential losses in a high wind event.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Property owner • Contractor • Building inspector • Project engineer 	<ul style="list-style-type: none"> • Note from project engineer or BCA analyst • Photos

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Visual 30: Type of construction

Why it's important:

- The BCA Toolkit uses the structure's construction type to estimate potential losses in a high wind event.

Source(s):

- Property owner
- Contractor
- Building inspector
- Project engineer

Recommended BCA documentation with application:

- Note from project engineer or BCA analyst
- Photos

Building properties before and after mitigation



Building properties before and after mitigation

- **What it is:**
 - Existence/type of roof, shutters, load path, etc. of the structure before and after the mitigation project.

Input required?	Potential sources	Recommended documentation with application
Yes	<ul style="list-style-type: none"> • Property owner • Contractor • Building inspector • Project engineer 	<ul style="list-style-type: none"> • Note from project engineer or BCA analyst • Photos

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Visual 31: Building properties before and after mitigation

What it is:

- Existence/type of roof, shutters, load path, etc. of the structure before and after the mitigation project.

Why it's important:

- The BCA Toolkit compares estimated losses before mitigation to estimated losses after mitigation. These are the benefits of the project.

Source(s):

- Project Scope of Work (SOW)
- Project engineer

Recommended BCA documentation with application:

- None other than normally required project materials

Unit 6 Review

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- In this unit we covered:
 - Project basics, data and documentation requirements, and BCA Toolkit exercises for:
 - Tornado safe rooms
 - Hurricane safe rooms
 - Hurricane wind retrofits

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Instructor:

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